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LETTER REGARDING STORMWATER ISSUES FORT SHERIDAN IL
6/23/2002
GREENHOME AND O'MARA, INC.

June 23, 2002 – Revised July 1, 2002

Mr. Ronnie Bostain, PE
Program Manager
Southern Div., Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

RE: Fort Sheridan Stormwater Issues

Dear Mr. Bostain:

On May 30 and May 31, 2002 G&O analyzed several issues related to the detention and conveyance of stormwater at Fort Sheridan. The purpose of this analysis is to identify the root cause of each of the issues related to stormwater detention and conveyance at Fort Sheridan. Fort Sheridan is located on the western shore of Lake Michigan roughly 35 miles north of Chicago, Illinois. Three primary issues related to stormwater were identified by Mr. Gary McDermott during the site visit. Several residences along Westover Road have experienced garage/basement flooding during recent moderate to heavy rainfall events. Stormwater overtops the intersection of the Ravine Road and the one way entrance to the ravine from Patten Road underneath the Patten Road Bridge. This overtopping is causing buckling of the pavement at this intersection. In another location along the Ravine Road, an above-ground stormdrain from the Town of Fort Sheridan outfalls onto the Ravine Road at roughly a ninety degree angle and the force of the water exiting this stormdrain has caused severe erosion of the roadway. A secondary issue relates to general erosion of the slope along the ravine road on the side adjacent to the Town of Fort Sheridan.

Executive Summary

Analysis of each of the above issues leads to the following general conclusions. The Westover Residences are flooding because the existing underground stormdrain system is not sized to handle the amount of stormwater runoff from onsite as well as offsite sources. Stormdrains at the Ravine Road intersection below the Patten Road Bridge need to be cleaned out and regularly maintained to prevent clogging which is a significant factor in the cause of stormwater overtopping. The piped stormdrain outfall from the Town of Fort Sheridan which outfalls onto the Ravine Road should be removed and replaced with a rip rap lined channel that intersects the existing roadway at an angle closer to forty-five degrees. Black corrugated plastic drain pipes, which originate in the Town of Ft. Sheridan should be removed from the slope along the ravine road. Additionally, further study should be conducted regarding the slumping and erosion of soil along the ravine road. The focus of this study should be to ensure that the Town of Fort Sheridan has employed proper stormwater management controls. Detailed discussions of each of the respective issues are provided below.

Westover Residences

The existing onsite stormdrain system is composed of a series of eight and twelve inch diameter pipes. It is estimated that this system was installed between fifty and sixty years ago. A schematic representation of a portion of this system is provided as Figure 1. The lines in Figure 1 represent stormdrain pipes with the arrows indicating the direction of flow. The numbered boxes indicate the relative location of combination stormdrain inlets and manholes.

Using a combination of topographic resources including a four foot contour interval Ft. Sheridan stormdrain map as well as a five foot contour interval USGS quadrange, a rough hydrologic study, employing the rational method, was undertaken in order to determine the amount of runoff that would enter into the stormdrain system given the nature of the existing on and offsite development during a 10-year

Sheridan Road

Figure 1 – Schematic Stormdrain Layout

storm event. A 10-year return period was chosen for the hydrologic model based on the recollection of Mr. McDermott that the residences do not flood during small to average rainfall events, but rather only during moderate to large rainfall events. Runoff coefficients for the onsite drainage area were approximated at 0.6, while 0.9 was used to approximate the amount of runoff that would be generated from the strip-malls on the west side of Sheridan Road, namely Sheridan Plaza and Fort Sheridan Square.

Considering the hydraulics of the existing stormdrain system, there is a finite amount of water that can flow through a given diameter of pipe at a given slope. Assuming an average slope of 0.01 for each of the pipe sections described in Figure 1, the maximum carrying capacity of a twelve inch diameter pipe based on Manning's formula is roughly 3.5 ft^3/s. Based on the results of the hydrologic study, it can be assumed that during a 10-year storm event all of the respective pipes described in Figure 1 are flowing full, which correlates with visual inspections conducted by Mr. McDermott.

Another observation of Mr. McDermott is that during storm events where flooding occurs, the residences on the northern end of Westover Road tend to flood prior to those on the southern end. Inspection of the onsite topography indicates that the grade generally slopes from south to north; however, more significantly manhole number 2174 is at the low point of the stormdrain system. Visual inspection of manhole 2174 reveals that there are four 12 inch diameter pipes that flow into this manhole as well as a four inch diameter road drain, while the outflow pipe is only 12 inches in diameter as well.

With roughly 14 ft^3/s flowing into this manhole and an outlet pipe that even under pressure has a discharge capacity of less than 5 ft^3/s, it is only a matter of time before the manholes and pipes in this system fill to capacity and flooding occurs. In order to avoid water backing up in the system, the outlet pipe needs to be sized so that it can handle flows from each of the respective inlet pipes. In this particular example, an outlet pipe installed at a slope of 0.01 would need to be at least 21 inches in diameter in order to discharge flow from each of the five inlets.

It is recommended that a more detailed study of the existing stormdrain system be conducted in which more accurate topography is used for the hydrologic model. As-built invert elevations, inlet grades and manhole locations should be obtained as well in order to more accurately model the hydraulics of the system. The figures quoted in the above analysis are rough at best and are meant to describe roughly what the issues are related to the hydrology and hydraulics of the system during a 10-year storm event.

Another factor to consider is the amount of flow that enters the Westover system from Sheridan Plaza and Fort Sheridan Square as well as Sheridan Road. Stormdrain design plans for Fort Sheridan Square were reviewed during the above analysis. These design plans indicated that a four inch diameter flow regulator has been placed at the outlet of the underground stormdrain system for Fort Sheridan Square. This flow regulator aids in preventing the full amount of stormwater runoff from the strip mall from flowing into Westover all at once. However, no such flow regulator could be verified for Sheridan Plaza. Also, it was observed during the site visit that there is a ravine behind Fort Sheridan Square that flows to the west. Conversations with personnel from the City of Highland Park and the Town of Highwood indicate that prior to the development of the strip malls land on the west side of Sheridan Road drained into this ravine. It is very likely that when the Westover stormdrain system was designed it was not anticipated that portions of Sheridan Road as well as future development to the west would be conveyed into this system.

Although not likely a significant factor in the recent flooding, a contributing factor may be the buildup of leaves and other debris in the road inlets and stormdrain pipes. Buildup of debris and sediment in the stormdrain system will serve to decrease the carrying capacity of the pipes and will exacerbate any discontinuity in inlet and outlet flows. It is recommended that these inlets be regularly maintained and cleared of any debris or sediment build-up.

Ravine Road at Patten Road Bridge

Stormwater overtops the intersection of the Ravine Road and the one way entrance to the ravine from Patten Road underneath the Patten Road Bridge. Inspection of this intersection reveals that a significant amount of sediment and debris have clogged the stormdrain inlets on the upstream end of this intersection. Although baseflow from the main stormwater management pond in the Town of Fort Sheridan flows through the sediment and debris, it is likely that during even moderate rainfall events the inlets are unable to collect the amount of stormwater that flows down the ravine parallel with Patten Road. When it rains, water likely backs up due to the clogged drains, eventually overtopping the intersection. This overtopping is causing buckling of the pavement at this intersection. Stormdrains at the Ravine Road intersection below the Patten Road Bridge need to be cleaned out and regularly maintained to prevent clogging which is a significant factor in the cause of stormwater overtopping.

Stormdrain Outfall onto Ravine Road

In another location along the Ravine Road an above-ground stormdrain from the Town of Fort Sheridan outfalls onto the Ravine Road from what appears to be a stormwater detention pond. The grade difference between the detention pond and the Ravine Road is roughly thirty feet and the stormdrain outfalls onto the road at a ninety degree angle. The force of the water exiting this stormdrain has caused severe erosion of the roadway.

In order to reduce both the quantity and the force of water flowing onto the Ravine Road the following modifications should be considered. Most importantly, the piped stormdrain outfall should be removed and replaced with a rip rap lined channel that intersects the existing roadway at an angle closer to forty-five degrees. Currently, the pond is configured so that the outlet is lower in elevation than the inlet. This design does not afford any detention or attenuation of stormwater flows in the existing pond. The outlet from the stormwater detention pond should be modified so that a rip rap or gabion weir is installed that will allow for detention in the existing pond area.

Ravine Road Slope Erosion

East of the Patten Road bridge, along the slope adjacent to the Town of Fort Sheridan, spot erosion and in one case slumping of the hillside is evident. A brief investigation of this area revealed that a number of black plastic corrugated pipes, which originate at the rear of properties located in the Town of Fort Sheridan convey stormwater onto this slope. The exact purpose for the placement of these pipes is not known, however, generally speaking water flowing through a pipe is more concentrated and travels faster than water traveling over land and would therefore exacerbate any erosion occurring along this slope. A review of the rear of the properties within the Town of Fort Sheridan that adjoin this slope did not indicate the presence of stormwater management measures that might serve to detain or slow down sheet flow originating within the Town of Fort Sheridan. A more detailed analysis of the drainage area to this slope within the Town of Fort Sheridan should be conducted. This analysis should focus on whether or not stormwater management practices employed by the Town of Fort Sheridan specifically address runoff directed towards the ravine slope.

Conclusion

Further analysis based on more accurate topographic and as-built information will be required in order to implement design modifications recommended to the stormdrain system at the Westover residences as well as the outfall from the Town of Fort Sheridan. With respect to the intersection below the Patten Road bridge, once the buckled pavement sections have been repaired, the stormdrain inlets in this area should be regularly maintained in order to prevent further overtopping of the road. Further analysis is also required in order to determine what if any modifications need to be implemented in order to prevent further slope erosion along the ravine road.

Should you wish to discuss the analysis or conclusions presented in this report please do not hesitate to contact me by telephone at 703-385-9800.

Sincerely,

Daniel C. Lucey, P.E.
Greenhorne & O'Mara, Inc.

cc: Gary McDermott – NTC Great Lakes
Robert Taylor – Southern Div. NAVFAC
Jack Marcus – Greenhorne & O'Mara, Inc.